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(54) **APPARATUS FOR A WELDING MACHINE HAVING A COOLING ASSEMBLY MOUNTED TO A MID-PLANE BAFFLE FOR IMPROVED COOLING WITHIN THE WELDING MACHINE**

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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**Related U.S. Application Data**

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(51) **Int. Cl.**  
**B23K 9/067** (2006.01)

(52) **U.S. Cl.** ..... **219/130.1**

(58) **Field of Classification Search** ..... 219/130.1, 219/136, 130.31, 130.32, 130.33, 130.5, 219/137 PS; 361/695

See application file for complete search history.

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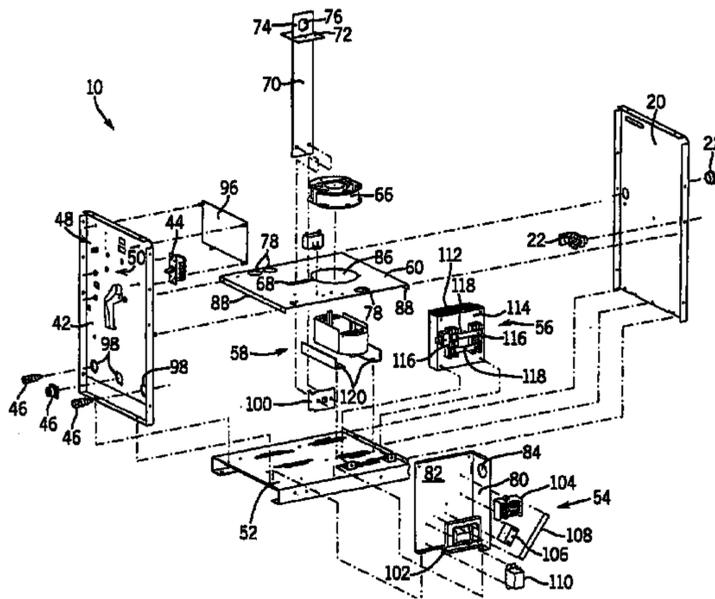
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(57) **ABSTRACT**

A mid-plane baffle or plate having a fan mounted thereto to dissipate heat within a welding machine is provided. By centrally positioning a baffle and mounting a circulating fan thereto, cooling efficiency is improved thereby enabling more direct cooling of the internal components of the welding machine. The baffle also reduces the critical volume of the welding machine and allows the fan to operate more efficiently and pull an increased amount of cooler ambient air through the machine which creates a greater cooling effect during the cooling cycle of the machine. The baffle placement also improves welding start performance by operating as a barrier between the high frequency/high voltage components and the PC board (control electronics) of the welding machine. The baffle also improves flexibility of component placement within the welding machine.

**22 Claims, 3 Drawing Sheets**





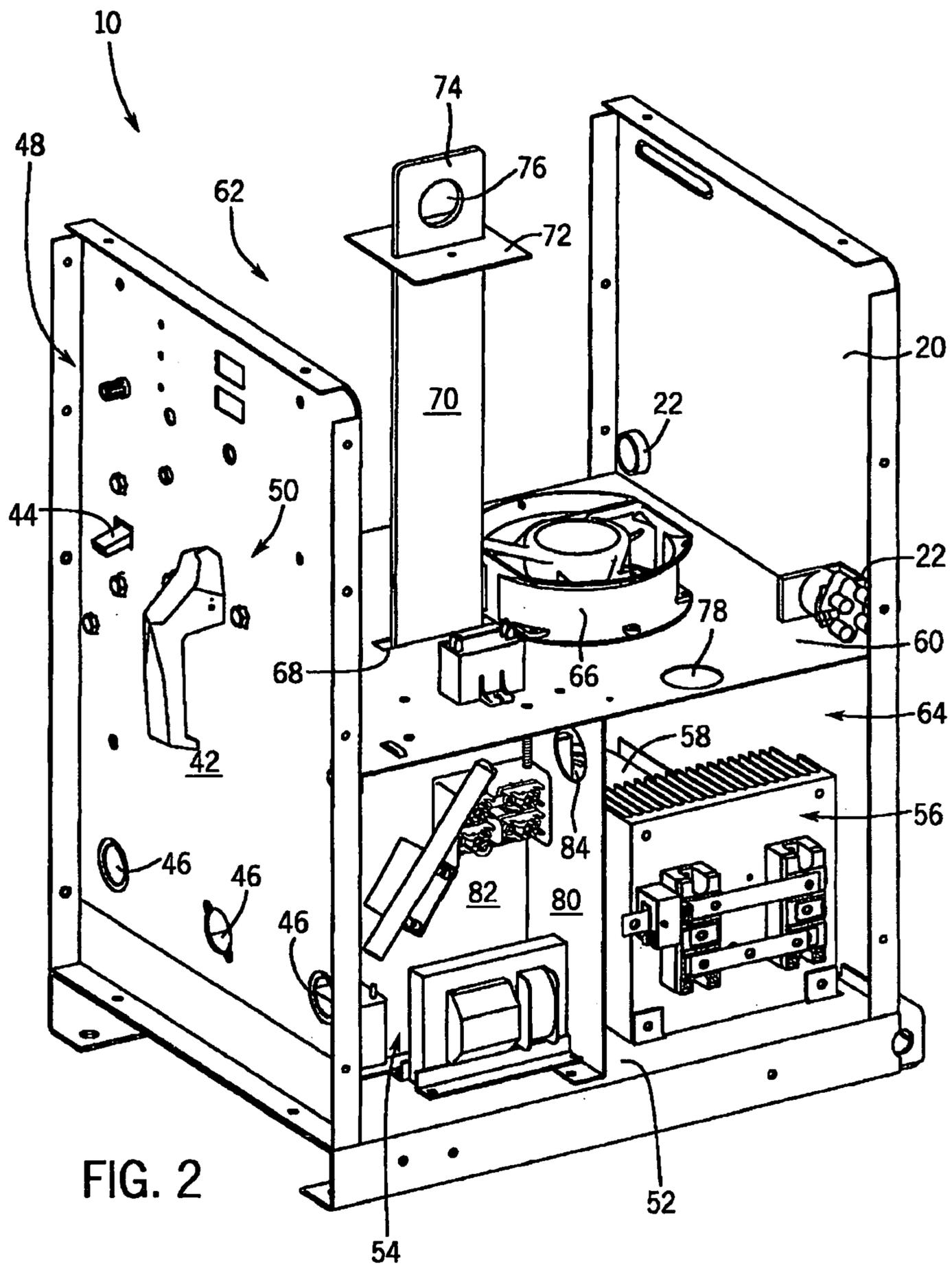


FIG. 2

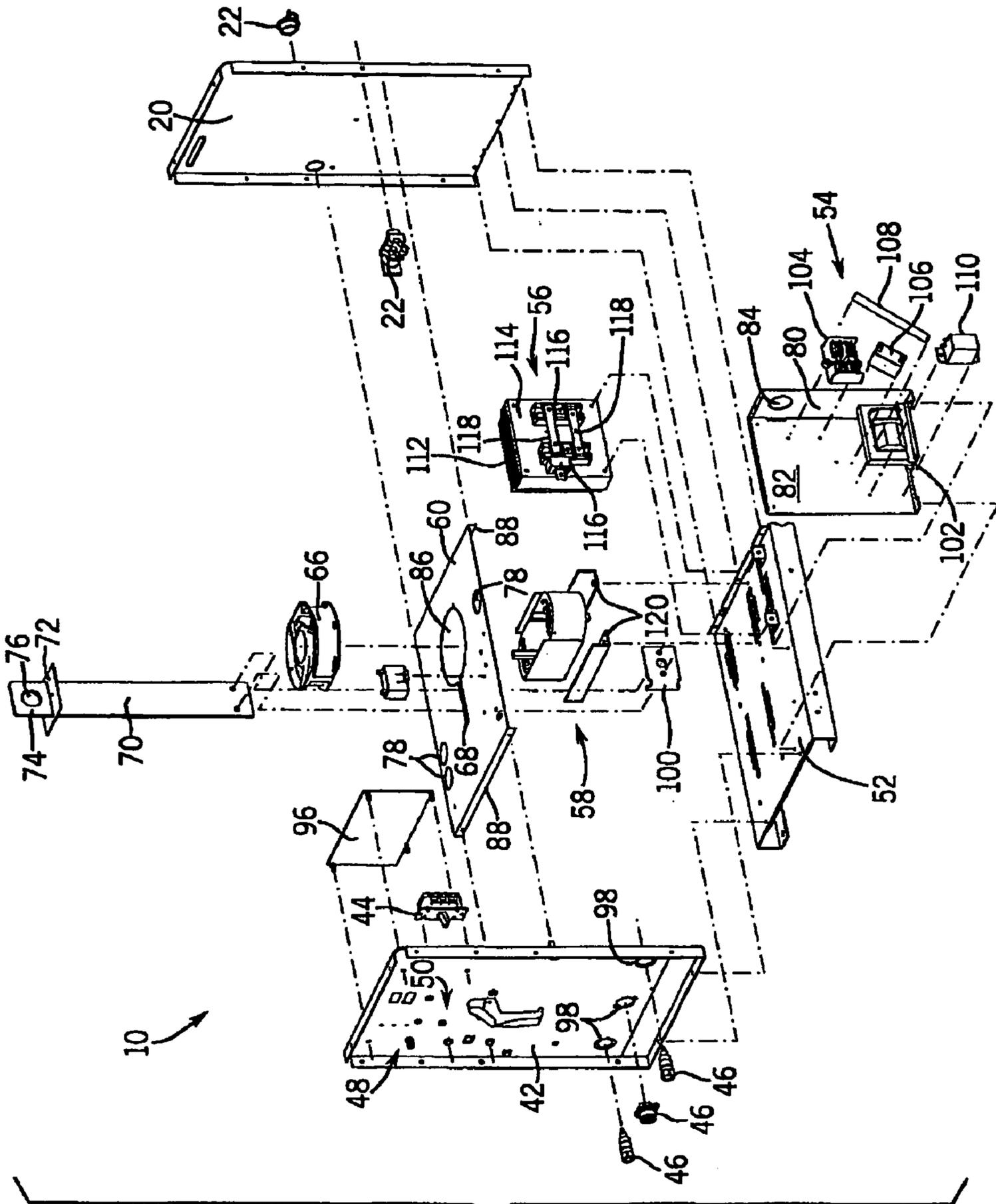


FIG. 4

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**APPARATUS FOR A WELDING MACHINE  
HAVING A COOLING ASSEMBLY MOUNTED  
TO A MID-PLANE BAFFLE FOR IMPROVED  
COOLING WITHIN THE WELDING  
MACHINE**

CROSS REFERENCE TO RELATED  
APPLICATION

The present invention is a continuation and claims the benefit and priority of U.S. Ser. No. 10/063,816 filed May 15, 2002, now U.S. Pat. No. 6,803,541, the disclosure of which is incorporated herein.

BACKGROUND OF THE INVENTION

The present invention relates generally to welding machines and, more particularly, to a welding machine having a mid-plane baffle for improved heat dissipation/cooling of the welding machine.

There are a large number of welding processes available for use in the industry. The most common welding processes include gas tungsten arc, oxygen gas welding, and shielded metal arc welding. The gas tungsten arc welding process is sometimes referred to as TIG (tungsten inert gas) welding. TIG welding is commonly performed by a TIG welding machine utilizing an inert gas.

A typical TIG welding machine includes a transformer, stabilizer and various electrical components that convert the input power into power suitable for welding. The transformer, stabilizer and electrical components are usually assembled into an enclosure or housing having a fan to dissipate heat generated by the components and thereby cool the internal housing.

Generally, the housing is defined by a front and back panel, two side panels, a base plate, and a top cover. The panels, base plate, and top cover collectively define a cavity or volume wherein the internal components of the welding machine are mounted. Typically, the fan is mounted to an external panel to dissipate heat generated throughout the housing. While the single cavity housing with an external panel mounted fan has adequately dissipated heat generated by the internal welding machine components, improved cooling efficiency is difficult to achieve without an increased size of the fan thereby increasing the overall manufacturing costs of the welding machine.

It would therefore be desirable to design a welding apparatus that decreases the critical volume within the welding apparatus housing and allows for alternate placement of a fan assembly to improve heat dissipation within the housing.

SUMMARY OF THE INVENTION

The present invention solves the aforementioned problems by providing a mid-plane baffle or plate having a fan mounted thereto to dissipate heat within a welding machine. By centrally positioning a baffle and mounting a circulating fan thereto, cooling efficiency is improved thereby enabling more direct cooling of the internal components of the welding machine. The baffle also reduces the critical volume of the welding machine and allows the fan to operate more efficiently and pull an increased amount of cooler ambient air through the machine which creates a greater cooling effect during the cooling cycle of the machine. The baffle placement also improves welding start performance by operating as a barrier between the high frequency/high

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voltage components and the PC board (control electronics) of the welding machine. The baffle also improves flexibility of component placement within the welding machine.

In accordance with one aspect of the present invention, a welding apparatus includes a housing defined by a first and a second panel, a base plate, and a top cover plate. The welding apparatus further includes a baffle extending from the first panel to the second panel wherein the baffle is disposed to define a top compartment and a bottom compartment within the housing.

In accordance with another aspect of the present invention, a welding machine includes a front panel and a back panel. The welding machine further includes a base plate and top plate connecting the front panel and the back panel to form a housing. A cross plate parallel to the base plate and the top plate is provided such that the cross plate defines a first volume and a second volume within the housing. The fan assembly is supported by the cross plate to circulate air in the first and the second volumes.

In accordance with a further aspect of the present invention, a method of manufacturing a welding machine with improved cooling efficiency is provided. The method includes the steps of connecting a first panel and a second panel to opposite ends of a base plate. The method also includes connecting a baffle plate having an opening parallel to the base plate such that the baffle plate generally bisects a height of each panel to form a first volume and a second volume. A fan is then positioned in the baffle plate opening wherein the fan is configured to circulate air in the first and the second volumes. A cover plate is then connected between the first panel and the second panel to enclose the internal components of the welding machine.

In accordance with yet a further aspect of the present invention, a cooling assembly kit for retrofitting a welding apparatus is provided. The cooling assembly kit includes a baffle plate having a bore configured to generally bisect an internal volume of the welding apparatus to form a first volume and a second volume. The cooling assembly kit further includes a fan assembly attached to the baffle plate through the bore to circulate air in the first and the second volumes.

Various other features, objects and advantages of the present invention will be made apparent from the following detailed description and the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings illustrated the best mode presently contemplated for carrying out the invention.

In the drawings:

FIG. 1 is a perspective view of a welding machine.

FIG. 2 is an assembled perspective view of the internal components of the welding machine of FIG. 1.

FIG. 3 is a perspective view of a baffle plate for use with the welding machine of FIG. 1.

FIG. 4 is an exploded perspective view of that shown in FIG. 2.

DETAILED DESCRIPTION OF THE  
PREFERRED EMBODIMENT

FIG. 1 is a perspective view of a welding machine 10, incorporating in one embodiment, a retractable rack assembly 12. The welding machine 10 comprises a housing 14 having a base 16, and a plurality of panels spaced apart from one another and extending upwardly from the base 16. The plurality of panels includes a front panel 18 with control

knobs and switches (not shown), a back panel **20** with control knobs and/or valves **22** and a pair of side panels **24**. A top cover **26** is secured to the panels that collectively enclose the internal components of the welding machine **10**. The top cover **26** has an opening **28** to allow access to the interior of the housing **14**. Panels **20**, **24** and top cover **26** are preferably fabricated from blank sheet metal as is well known in the art. A pair of support bars **30** extend outwardly from housing **14** and a strap **31** to support an upper portion of a gas cylinder (not shown). The retractable rack assembly **12** supports the body of a gas cylinder when extended outwardly from base **16**. Alternately, welding machine **10** may be constructed without rack assembly **12** and support bars **30** and strap **31** for welding conditions/sites not in need of a gas cylinder.

Rack assembly **12** is slidably coupled to the base **16** of the housing **14** to allow retraction of the rack assembly **12** into a closed position. In the closed position, rack assembly **12** is engaged with base **16** of housing **14**. A locking device (not shown) couples the rack assembly to the base on both sides of the housing. Wheels **38**, **40** and handle **42** enable the welding machine **10** to be maneuvered and transported with ease to different job sites. Each wheel **38** may be equipped with a wheel-locking mechanism (not shown) to limit the transportability of the welding machine. Wheel **40** is coupled to an undersurface of the base **16** and is configured to freely pivot to assist with turning of the welding machine. Alternately, machine **10** may be constructed without wheels **38**, **40** and handle **42** for non-transportable embodiments.

Referring now to FIG. 2, an assembled perspective view of the internal components of a welding machine similar to that shown in FIG. 1 is illustrated. The internal frame of welding machine **10** includes back panel **20** and a front mounting plate **42**. Extending through mounting plate **42** is an on/off switch **44** and a number of sockets **46** configured to engage various welding plugs and connectors such as a work cable, torch cable, and/or other service plugs and pins. Mounting plate **42** further supports control knobs **48** for control and operation of the welding machine. As will be described with greater detail with respect to FIG. 4, mounting plate **42** further includes a number of fasteners **50** such as bolts that secure a support plate to an interior surface of mounting plate **42**.

Connected between back panel **20** and mounting plate **42** is a base plate **52** configured to support the internal components of the welding machine **10**. For example, base plate **52** supports a high frequency transformer assembly **54**, a heat sink and rectifier assembly **56**, and a stabilizer assembly **58**. Transformer assembly **54**, heat sink and rectifier assembly **56**, and stabilizer assembly **58** will be described in greater detail with respect to FIG. 4.

Still referring to FIG. 2, to improve cooling and heat dissipation within the welding machine, the present invention incorporates a mid-plane baffle or plate **60** that generally bisects the internal volume of the welding machine to form a first volume **62** and a second volume **64**. Baffle **60** supports a rotating fan **66** designed to dissipate heat in the first volume **62** as well as the second volume **64**. Positioning baffle **60** to generally bisect the height of back panel **20** and mounting plate **42** reduces the critical volume of the welding machine **10** and allows the fan **66** to operate more efficiently by pulling an increased amount of cooler ambient air through the welding machine **10** which creates a greater cooling effect during the cooling cycle of the machine. Mid-plane placement of the baffle **60** also improves welding start performance as operating as a barrier between the high frequency/high voltage components and the PC board/con-

trol electronics (not shown) of the welding machine. As will be discussed in greater detail below, the baffle **60** also improves flexibility of component placement within the welding machine.

Baffle **60** further includes a slot **68** that receives a frame support **70** extending from base plate **52** to the top of the welding machine **10**. Frame support **70** includes a flange **72** for mounting front cover plate **26**, FIG. 1. Extending from flange **72** through the top cover **26** as shown in FIG. 1 is a lifting plate **74** having a bore **76** therethrough. Bore **76** is designed to receive a chain so that welding machine **10** may be lifted by a crane or forklift assembly to transport the welding machine from one location to another. Additionally, a locking mechanism may be inserted through bore **76** to secure the welding machine **10** to a wall or other support structure to limit transportability of the welding machine.

Still referring to FIG. 2, baffle **60** includes at least one orifice **78** designed to allow air to pass between the first volume **62** and the second volume **64**. Additionally, mounted to an undersurface of baffle **60** and extending orthogonally to base plate **52** is a pair of sectioning plates **80**, **82**. Sectioning plates **80**, **82** serve as a divider between the high frequency transformer assembly **54** and the remaining internal components housed in the second volume **64**. Sectioning plate **80** further includes an orifice **84** to allow air to circulate between the housing for the high frequency transformer **54** formed by sectioning plates **80**, **82** and the remainder of the second volume **64**. It is noted that sectioning plate **80** is perpendicular to the plane of support frame **70** whereas sectioning plate **82** is parallel to the plane of frame support **70**. As indicated previously, sectioning plates **80**, **82** operate to provide a housing for the high frequency transformer assembly **54** and thereby create a first compartment and a second compartment for housing internal components of welding machine **10** within the second volume **64**.

Referring to FIG. 3, a perspective view of baffle **60** is illustrated. As shown, baffle **60** includes an orifice **86** in which fan **66** is mounted over. As such, fan **66** is able to dissipate heat in both the first volume and the second volume as heretofore described. Further shown in FIG. 3 is slot **68** for receiving support frame **70** and orifices **78** that allow air to communicate between the first and second volumes **62**, **64**. Baffle **60** further includes a 90° lip **88** at opposite ends **90**, **92** so that baffle **60** may be fasteningly secured to mounting plate **42** and back panel **20** of FIG. 2. Baffle **60** further includes a number of fastening bores **94** configured to receive bolts or other fastening devices to securely mount additional welding components such as circuit boxes thereto.

Referring now to FIG. 4, an exploded view of that shown in FIG. 2 is illustrated. As indicated previously, mounting plate **42** is configured to support a switch **44** and control knobs **48**. Switch **44** and controls **48** are secured to mounting plate **42** by a securing plate **96** that is affixed to an interior surface of mounting plate **42**. Furthermore, sockets **46** are designed to engage orifices **98** of mounting plate **42**. As indicated previously, sockets **46** are designed to receive various welding connectors such as a torch connector or work cable. The assembled mounting plate **42** is configured to be securely fastened to base plate **52** such that base plate **52** supports the vertical mounting plate **42**. Additionally, base plate **52** is also designed to support back panel **20** along a side opposite to mounting plate **42** such that mounting plate **42**, base plate **52**, and back panel **20** collectively form a U-shaped frame. Bisecting mounting plate **42** and back panel **20** is baffle **60** designed to bisect the interior volume of the welding machine into a first volume and a second

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volume. Mounted through orifice **86** of baffle **60** is fan **66** designed to dissipate heat both the first volume and the second volume. A support frame **70** is designed to pass through a slot **68** of baffle **60** and attach to a mounting plate **100** that is mounted to stabilizer assembly **58**. A transformer assembly (not shown) is also mounted to mounting plate **100** and supported by base plate **52**. Support frame **70** extends vertically through the center of the welding machine and includes a flange that engages a top cover **26**, FIG. **1**, to support lifting of the welding machine by a crane or forklift.

As indicated previously, baffle **60** includes a number of orifices **78** to allow air communication between the first and second volumes and therefore provide a pressure equilibrium between the first and second volumes. Additionally, orifices **78** may be used for passing of wires between the two volumes. Preferably, baffle **60** is fabricated from a sheet of metal and includes lips **88** that enable securing of the baffle **60** to mounting plate **42** and rear panel **20** as shown.

As indicated previously, welding machine **10** further includes a housing defined by sectioning plates **80**, **82** for a HF transformer assembly **54**. Sectioning plates **80**, **82** are mounted to and supported by base plate **52** to segment the second or lower volume into a first sub-volume and a second sub-volume as heretofore described. In accordance with known construction techniques, transformer assembly **54** includes an HF box **102** mounted to sectioning plate **82** as well as a transformer **104**, a capacitor **106**, and a resistor **108** that are collectively mounted to sectioning plate **82**. Mounted to HF box **102** is a spark gap assembly **110**.

Rectifier and heat sink assembly **56** includes a heat sink **112** mounted to a rectifier bracket **114**. Rectifier assembly **56** further includes thyristors **116** and a pair of bus bars **118**. Rectifier assembly **56** is mounted to and supported by base plate **52** and is sectioned from the high frequency transformer assembly **54** by sectioning plates **80**, **82**.

Also sectioned from HF transformer assembly **54** by sectioning plates **80**, **82** is a stabilizer assembly **58**. Stabilizer assembly **58** is supported by base plate **52** and mounted thereto by a pair of elbow-shaped brackets **120**.

Accordingly, the present invention includes a method of manufacturing a welding machine with improved cooling efficiency. The method includes the steps of connecting a first panel and a second panel to opposite ends of the base plate and connecting a baffle plate having an opening parallel to the base plates such that the baffle plate generally bisects a height of each panel to form a first volume and a second volume within the internal housing of the welding machine. A fan is then positioned on the baffle plate opening such that heat may be dissipated in the first and second volumes. A cover plate is then connected between the first panel and the second panel to enclosed the internal components of the welding machine. Alternately, a pair of sectioning plates may be disposed between the baffle plate and the base plate to further section the second volume into a pair of sub-volumes. Additionally, the pair of sectioning plates also provide a housing for the high frequency transformer assembly. That is, the rectifier and heat sink assembly and stabilizer are positioned in a sub-volume separate from the sub-volume housing the HF transformer assembly. Manufacturing a welding machine in accordance with the aforementioned design enables flexibility and placement of the fan assembly to improve heat dissipation and air circulation within the welding machine. Additionally, as a result of a layout conducive to improved cooling, a smaller fan may be utilized or alternatively larger internal components with greater heat production. The present invention may also be

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embodied in a kit to retrofit a welding machine to improve the cooling efficiency of the device.

In accordance with one embodiment of the present invention, a welding apparatus includes a housing defined by a first and a second panel, a base plate, and a top cover plate. The welding apparatus further includes a baffle extending from the first panel to the second panel wherein the baffle is disposed to define a top compartment and a bottom compartment within the housing.

In accordance with another embodiment of the present invention, a welding machine includes a front panel and a back panel. The welding machine further includes a base plate and top plate connecting the front panel and the back panel to form a housing. A cross plate parallel to the base plate and the top plate is provided such that the cross plate defines a first volume and a second volume within the housing. The fan assembly is supported by the cross plate to circulate air in the first and the second volumes.

In accordance with a further embodiment of the present invention, a method of manufacturing a welding machine with improved cooling efficiency is provided. The method includes the steps of connecting a first panel and a second panel to opposite ends of a base plate. The method also includes connecting a baffle plate having an opening parallel to the base plate such that the baffle plate generally bisects a height of each panel to form a first volume and a second volume. A fan is then positioned in the baffle plate opening wherein the fan is configured to circulate air in the first and the second volumes. A cover plate is then connected between the first panel and the second panel to enclosed the internal components of the welding machine.

In accordance with yet a further embodiment of the present invention, a cooling assembly kit for retrofitting a welding apparatus is provided. The cooling assembly kit includes a baffle plate having a bore configured to generally bisect an internal volume of the welding apparatus to form a first volume and a second volume. The cooling assembly kit further includes a fan assembly attached to the baffle plate through the bore to circulate air in the first and the second volumes.

While the present invention has been described with respect to a phase controlled TIG welder, the present invention is equivalently applicable with an inverter controlled TIG welder, or a hybrid phase controlled/inverter controlled TIG welder. Additionally, the present invention is applicable with non-TIG welding machines and systems.

The present invention has been described in terms of the preferred embodiment, and it is recognized that the equivalent, alternatives, and modifications, aside from those expressly stated, are possible and within the scope of the appending claims.

The invention claimed is:

1. A cooling assembly kit for retrofitting a welding apparatus, the kit comprising:
  - a baffle plate having a bore configured to be mounted to and between a pair of parallel frame plates of a welding apparatus to generally bisect an internal volume of the welding apparatus to form a first volume on one side of the baffle plate and a second volume on an opposite side of the baffle plate; and
  - a fan assembly attachable to the baffle plate through the bore to circulate air in the first and the second volumes; wherein the baffle plate includes a plurality of orifices to enable a pressure equilibrium between the first volume and the second volume.

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2. The cooling assembly kit of claim 1 wherein the fan assembly circulates air in the first volume and the second volume.

3. The cooling assembly kit of claim 1 wherein the baffle plate is designed to bisect the internal volume such that the first volume is of equal size as the second volume.

4. A cooling assembly kit for retrofitting a welding apparatus, the kit comprising:

a baffle plate having a bore configured to generally bisect an internal volume of the welding apparatus to form a first volume and a second volume;

a fan assembly attachable to the baffle plate through the bore to circulate air in the first and the second volumes; and

wherein the baffle plate includes a plurality of orifices to enable a pressure equilibrium between the first volume and the second volume.

5. A welding apparatus comprising:

a housing defined by a first and a second panel, a base plate, and a top cover plate; and

a baffle extending from the first panel to the second panel, the baffle being disposed within the housing to define a top compartment and a bottom compartment within the housing and having a plurality of orifices to enable a pressure equilibrium between the top compartment and the bottom compartment.

6. The welding apparatus of claim 5 further comprising a fan configured to dissipate heat within the housing, the fan being supported by the baffle.

7. The welding apparatus of claim 6 wherein the baffle includes a recess defined to receive the fan to dissipate heat within the housing.

8. The welding apparatus of claim 7 wherein the recess is defined in the baffle such that the fan circulates air in the top compartment and the bottom compartment.

9. The welding apparatus of claim 5 further comprising a plurality of wire passages in the baffle to facilitate passage of electrical wires between the top and the bottom compartments.

10. The welding apparatus of claim 5 wherein the baffle includes a mid-plane cross plate formed of sheet metal and a slot sized to receive a lifting eye assembly extending from the base plate and through the top cover plate.

11. A welding machine comprising:

a front panel and a back panel;

a base plate and a top plate connecting the front panel and the back panel to form a housing;

a cross plate parallel to the base plate and the top plate such that the cross plate defines a first volume and a second volume within the housing; and

a plurality of air passages formed in the cross plate to reduce a pressure differential between the first volume and the second volume.

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12. The welding machine of claim 11 wherein the cross plate includes a recess configured to receive an oscillating fan assembly to circulate air in the first and the second volumes simultaneously.

13. The welding machine of claim 12 wherein the oscillating fan assembly is oriented parallel to the base plate and the top plate.

14. The welding machine of claim 11 wherein the cross plate includes a slot sized to receive a lifting eye assembly extending through the housing.

15. The welding machine of claim 11 further comprising a box disposed in the second volume, the box being defined by a pair of sectioning plates and having a transformer assembly therein.

16. The welding machine of claim 11 incorporated into at least one of a phase controlled TIG welder, an inverter controlled TIG welder, and a hybrid phase controlled/inverter controlled TIG welder.

17. A method of manufacturing a welding machine with improved cooling efficiency, the method comprising the steps of:

connecting a first panel and a second panel to opposite ends of a base plate;

connecting a baffle plate having a number of air passages perpendicular to the base plate wherein the baffle plate generally bisects a height of each panel to form a first volume and a second volume and the number of air passages are constructed to support a pressure equalization between the first and the second volumes; and

connecting a cover plate between the first panel and the second panel.

18. The method of claim 17 further comprising the step of connecting a pair of sectioning plates between the baffle plate and the box plate.

19. The method of claim 18 wherein the step of connecting the pair of sectioning plates includes the step of positioning the sectioning plates to be orthogonal to the baffle plate.

20. The method of claim 19 further comprising the step of defining a first sub-volume and a second sub-volume in the second volume with the connection of the pair of sectioning plates.

21. The method of claim 20 further comprising the step of positioning an HF transformer assembly in the first sub-volume and a heat sink and rectifier assembly in the second sub-volume.

22. The method of claim 17 further comprising the step of defining a recess in the baffle plate sized to receive a fan assembly and positioning a fan assembly in the recess to circulate air in the first and the second volumes.

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